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TORRENT UTILITY BOARD Calibration and Test Procedure

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1.0 Introduction

This document covers the calibration and testing strategy for the TORRENT Utility Transition Board to take the board from post-manufacture to a fully functional state. All tests described in this document pertain to the latest hardware revision level of the subject board. The tests described here do not prove that the board under test will meet specification but do test the full functionality of the board and identify failures that may be the result of component and manufacture problems. The test procedure assumes that the tester is familiar with the use of the mBORG Engineering Console (MEC) and can execute the required commands. The tests are divided into progressive stages ranging from 1 to N. Each higher number stage uses assumptions on the board condition that requires the previous stages to have been successfully completed.

In the description for these tests, certain conventions are followed to ease comprehension. These conventions and examples of each are presented in Table 1.

Table 1 - Test Description Conventions

Convention	Example	Description
Linux commands that are typed on a PAN xterm window	<i>mecStart</i>	Boldface italics
Values typed to the MEC	"noise1.ucd"	Character in quotes
Buttons on the Detector Head Electronics (DHE) boards or MEC console	> <i>startExp</i> <	Bold italics underlined inside > < symbols
Linux commands that are typed for iraf image analysis	<i>dir</i>	Italics
Specific board signal names		boldface small capitals
MEC attribute names	mcbCodeID	Boldface italics

The result of each test will be recorded on an Acceptance Test Report Checklist, TRNT_EL_08_0009_SNnnnn (where SNnnnn is the serial number). This file should be saved to the official document control area of the TORRENT project in the following directory:

\\big-boy\MNSN\engr_Development\Torrent\DOC_CTRL\EL-08\08-0009_TransUtil

This file shall be deemed the official record of the test results that may be printed out and kept in the system binder and/or supplied to the end user. All entries of data shall be made as required per this test Procedure and the Acceptance Test Report Checklist.

1.1 Required Equipment

- Variable Power Supply – Hewlett Packard 6218A or Equivalent
- Temperature Resistor Load Fixture - TRNT-TS-05-0002
- Oscilloscope - Agilent MSO7034B or equivalent
- Digital Mutimeter –Fluke 77 or equivalent
- Board Vice

1.2 Test Schedule

Stage 1 Preparation of Documentation


Step 1.1.1 Locate the Assembly Record Tag (ART) for the AFE Board to be tested. The ART is a record of every action that has been taken on the board. AFE ARTs are located in:

\\big-boy\enrg_Development\Torrent\DOC_CTRL\EL-07_ARTs\07-0009_TransUtil

Locate testing info section and insert relevant test info as required

Step 1.1.2 Using a comparison photograph or a known good board, visually inspect the board for physical damage, missing and misplaced components. Figure 1 shows a typical Transition Utility Board. The particular board under test may not have exactly the same layout as pictured.

INSERT PICTURE HERE



Serial
Number

Figure 1. Typical Transition Utility Board

Step 1.1.3 Note and correct any non-conformances. Save the ART record, as required.

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- Step 1.1.4 Locate the Trans Utility Test Report Template. This template must be used to document the testing sequence and measured test values. This report shall be reviewed by the Project Engineer for acceptance of the overall board performance. The AFE Test Report Template can be located in:
\\big-boy\enr_Development\Torrent\DOC_CTRL\EL-08\08-0009_TransUtil

Stage 2 Transition Utility Board Test Setup

- Step 2.1 Secure the Trans Utility board under test to a Board Vice, so that potentiometers RV1 thru RV4 are easily accessible.
- Step 2.2 Locate the Input Power Connector Cable, W3 on the Temperature Resistor Load Test Fixture. Refer to Figure 2.

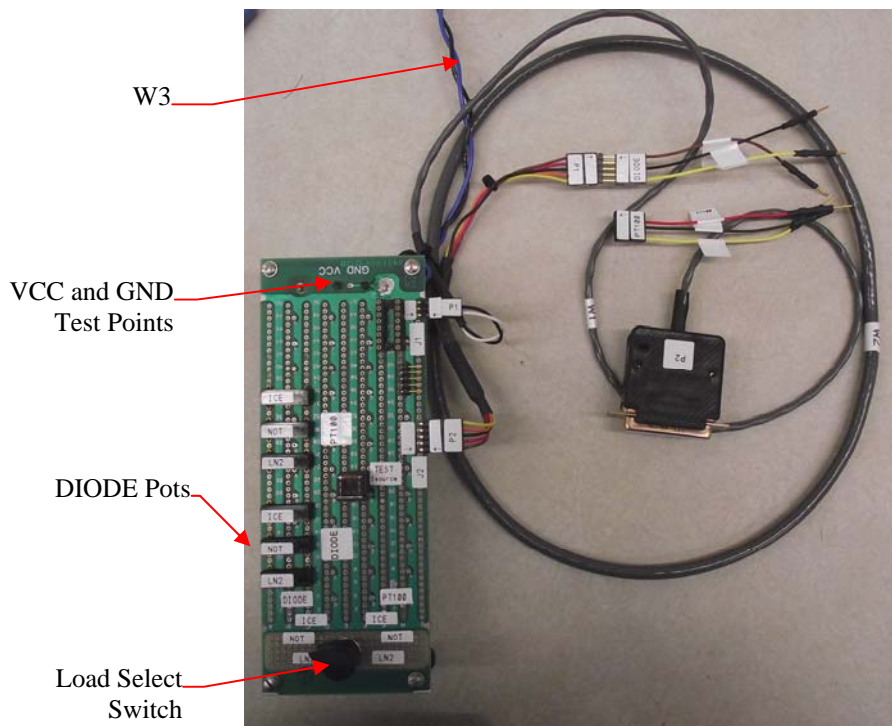


Figure 2. Temperature Resistor Load Test Fixture

- Step 2.3 Connect W3 to the Variable Power Supply.
NOTE: The BLUE wire corresponds to positive polarity (+).
The BLACK wire corresponds to the negative polarity (-).
- Step 2.4 Apply 12V to the Test Fixture. Use a DVM to verify 12V across the GND and VCC test points of the Test Fixture. Power off the Variable Power Supply.
- Step 2.5 Locate the input Positronix Connector, J1 on the Trans Utility Board. Connect the Input Cable Plug P2 of the Test Fixture to J1 of the Trans Util Board.

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Step 2.6

Locate the Resistive Load Cable, W2 on the Test Fixture.

Set the DIODE Load Select Switch on the Test Fixture to the Normal Operating Temperature (“NOT”) position.

Use a DVM to measure the Load Resistance of the NOT setting across the BROWN and BLACK leads of W2. Adjust the DIODE NOT Potentiometer as required to meet the required resistance requirement.

NOTE: Refer to the Trans Utility Acceptance Test Checklist for acceptable tolerance values.

Record the measured NOT Load value on the Trans Utility Acceptance Test Checklist where provided.

Step 2.7

Set the DIODE Load Select Switch on the Test Fixture to the ICE POINT (“ICE”) position.

Use a DVM to measure the Load Resistance of the ICE setting across the BROWN and BLACK leads of W2. Adjust the DIODE ICE Potentiometer as required to meet the required resistance requirement.

NOTE: Refer to the Trans Utility Acceptance Test Checklist for acceptable tolerance values.

Record the measured ICE Load value on the Trans Utility Acceptance Test Checklist where provided.

Step 2.8 Insert the Resistive Load leads of the Test Fixture to CH1 Temp Sensor pads “1V+” and “1V-“ of the Trans Utility Board. Refer to Figure 3 for locations. Reapply 12V to the Test Fixture.

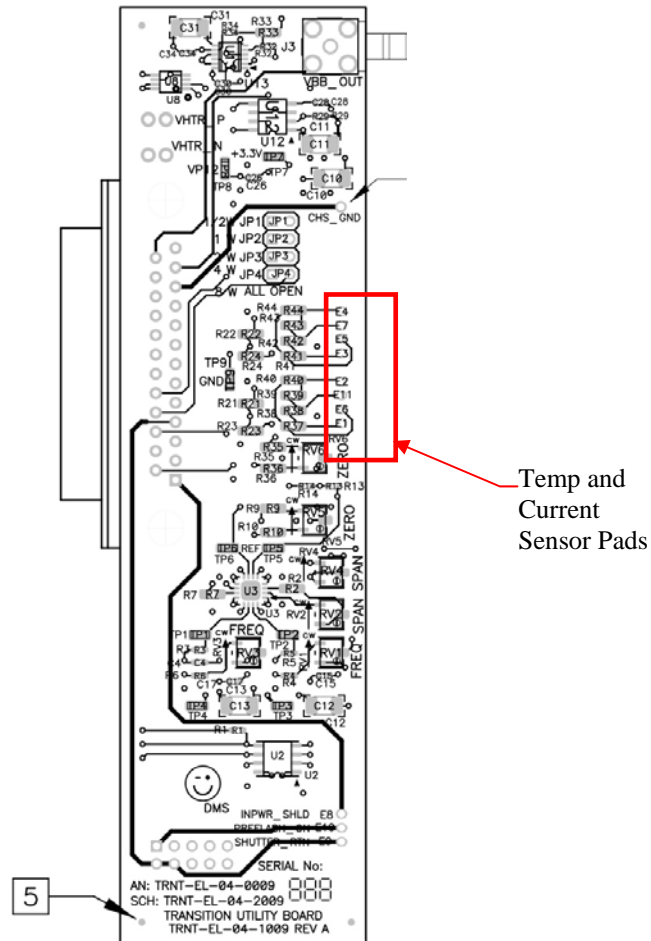


Figure 3. Utility Board Temp Sensor Pads

Stage 3 Transition Utility Calibration Sequence

3.1 Temperature Calibration

Step 3.1.1 Set the DIODE Load Select Switch on the Test Fixture to the NOT position. Measure the voltage at TP1 on the Trans Utility Board.

Step 3.1.2 Adjust the “ZERO” Trim Pot for CH1, RV5, as required to obtain a voltage of 1.73V (+/- 0.02V) at TP1.

Set the DIODE Load Select Switch on the Test Fixture to the ICE position.

Adjust the “SPAN” Trim Pot for CH1, RV4, as required to measure a voltage of 2.73V (+/- 0.02V) at TP1.

Return the DIODE Load Select Switch on the Test Fixture to the NOT position and observe the voltage.

NOTE: The voltage at TP1 may have changed to another value. This result is typical due to the Utility Board Circuitry functions. As a result, several adjustments to the ZERO and SPAN Pots RV5 and RV4 will be necessary to obtain the required voltage on TP1.

NOTE: The CH1 ZERO Pot, RV5, must be always be adjusted with the DIODE Load Select Switch on the Test Fixture in the NOT position.

NOTE: The CH1 SPAN Pot, RV4, must be always be adjusted with the DIODE Load Select Switch on the Test Fixture in the ICE position.

Step 3.1.3 Repeat Step 3.1.2 as many times as necessary to obtain the required ZERO and SPAN Voltages for CH1.

Once the measured voltage meets the requirements for CH1, record the acceptable value on the Trans Utility Acceptance Test Checklist where provided.

Step 3.1.4 Insert the Resistive Load leads to CH2 Temp Sensor pads “2V+” and “2V-“ of the Trans Utility Board. Refer to Figure 2 for locations.

Set the DIODE Load Select Switch on the Test Fixture to the NOT position.

Measure the voltage at TP2 on the Trans Utility Board.

Step 3.1.5 Adjust the “ZERO” Trim Pot for CH2, RV6, as required to obtain a voltage of 1.73V (+/- 0.02V) at TP2.

Set the DIODE Load Select Switch on the Test Fixture to the ICE position.

Adjust the “SPAN” Trim Pot for CH2, RV2, as required to measure a voltage of 2.73V (+/- 0.02V) at TP2.

Return the DIODE Load Select Switch on the Test Fixture to the NOT position and observe the voltage.

NOTE: The voltage at TP2 may have changed to another value. This result is typical due to the Utility Board Circuitry functions. As a result, several adjustments to the ZERO and SPAN Pots RV6 and RV2 will be necessary to obtain the required voltage on TP2.

NOTE: The CH2 ZERO Pot, RV6, must be always be adjusted with the DIODE Load Select Switch on the Test Fixture in the NOT position.

NOTE: The CH2 SPAN Pot, RV2, must be always be adjusted with the DIODE Load Select Switch on the Test Fixture in the ICE position.

Step 3.1.6 Repeat Step 3.1.5 as many times as necessary to obtain the required ZERO and SPAN Voltages for CH2.

Once the measured voltage meets the requirements for CH2, record the acceptable value on the Trans Utility Acceptance Test Checklist where provided.

3.2 Frequency Calibration

Step 3.2.1 Insert the Resistive Load leads to CH1 Temp Sensor pads “1V+” and “1V-“ of the Trans Utility Board. Refer to Figure 2 for locations.

Set the DIODE Load Select Switch on the Test Fixture to the ICE position.

Use an oscilloscope to measure the frequency at TP4 on the Trans Utility Board.

Step 3.2.2 Adjust the “FREQ” Trim Pot for CH1, RV3, as required to obtain a frequency of 142.1kHz (+/- 0.02) at TP4.

Record the acceptable value on the Trans Utility Acceptance Test Checklist where provided.

Step 3.2.3 Set the DIODE Load Select Switch on the Test Fixture to the NOT position.

Verify that TP4 measures 88.9kHz (+/- 0.02V).

NOTE: The FREQ Pot may rarely require adjustment in the NOT position. Always verify acceptable frequency at TP4 in both the ICE and NOT DIODE Load Select Switch positions.

Record the acceptable value on the Trans Utility Acceptance Test Checklist where provided.

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- Step 3.2.4 Insert the Resistive Load leads to CH2 Temp Sensor pads “2V+” and “2V-“ of the Trans Utility Board. Refer to Figure 3 for locations.
Set the DIODE Load Select Switch on the Test Fixture to the ICE position.
Use an oscilloscope to measure the frequency at TP3 on the Trans Utility Board.
- Step 3.2.5 Adjust the “FREQ” Trim Pot for CH2, RV1, as required to obtain a frequency of 142.1kHz (+/- 0.02V) at TP3.
Record the acceptable value on the Trans Utility Acceptance Test Checklist where provided.
- Step 3.2.6 Set the DIODE Load Select Switch on the Test Fixture to the NOT position.
Verify that TP3 measures 88.9kHz (+/- 0.02V).
NOTE: The FREQ Pot may rarely require adjustment in the NOT position. Always verify acceptable frequency at TP3 in both the ICE and NOT DIODE Load Select Switch positions.
- Step 3.2.7 Remove the Resistive Load leads from CH2 Temp Sensor Pads.
Turn OFF the Test Unit by shutting down the 12V Power Supply.

The Calibration sequence of the Trans Utility Board is now considered complete. Proceed to the Functionality Testing sequences below.

3.3 Current Source Verification

- Step 3.3.1 Locate the Util Board to Power Supply Cable cxxxxx.
Locate the Torrent Under Test Unit.
Install cable into J1 of the Utility Board under test. Connect the other end to the Test Unit Power Supply connector. Refer to Figure 4.
Connect a DVM to J1 on the Util Board Under Test with the RETURN lead on J1(25) and the other lead on J1(12).

Figure 4. Fiber Link and Buffer Status

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- Step 3.3.2 Insert a 100Kohm resistor across the “1I+” and “I-“ pads of the Trans Utility Board. Refer to Figure 3 for locations.
- Step 3.3.3 Turn on Test Unit by pressing and holding the Power Button for TWO seconds then release. Successful Test Unit power up is achieved by verifying that the: Green LED Power Button illuminates, fan blower turn on and Red LED status lights illuminate on the RS244 LCB Connectors.
- Step 3.3.4 Open one xterm window on the PAN. In the first xterm window, type *fs0* and look at the fiber link status. The status will probably show data in the receive FIFO buffer and should show the DHE to be in reset mode by having the *dir(ection)* bit true in the IO register (*i=01xx0*). The status command should return something similar to the following:

```

FibreXtreme (SL) Monitor (sl_mon) rev. 3.02 (2003/10/06)
Driver: rev. b2-835455:776764 for Linux with API rev. 2.1
Hardware: unit/bus/slot 0/1/4 - SL100 (D64) Firm. 1C.13 (1C.13)
for 5.0V PCI
  Link Control Register (CSR 0x08) = 0x37
  Link Status Register (CSR 0x0c) = 0x200      Link is UP
  FPDP Flags Register (CSR 0x10) = 0x200      NR.D.P2.P1.S:
i=01110 o=00000
  FIFO Threshold Register (CSR 0x14) = 0x0      Int.thr. = 0x0
  Data count                = 0xE75D (59229) bytes
  Link (and other) Errors    = 3
Configurable parameters:
Loop Configuration: 0 (Point-to-Point)
Max Timeout: 600000 (6000000 ms)
Flow Control: 0 (NO) Halt on link error:
1 (YES)
CRC generate/check: 1 (YES) Allow Queuing on link error:

```

Figure 5. Fiber Link and Buffer Status

- Step 3.1.5 Use the command *fc0* to clear the read buffer. Repeat the *fc0* command as required to clear any link errors. Confirm with the status command that the read FIFO buffer is now empty (*Data count = 0x0 (0) bytes*) and that no link errors persist.

Step 3.1.6 In the xterm window, start the PAN software and the mBORG using the command:

runManual mastodon &

The mBORG Engineering Console (MEC) and mBORG Welcome windows will be displayed as shown in Figure 6.

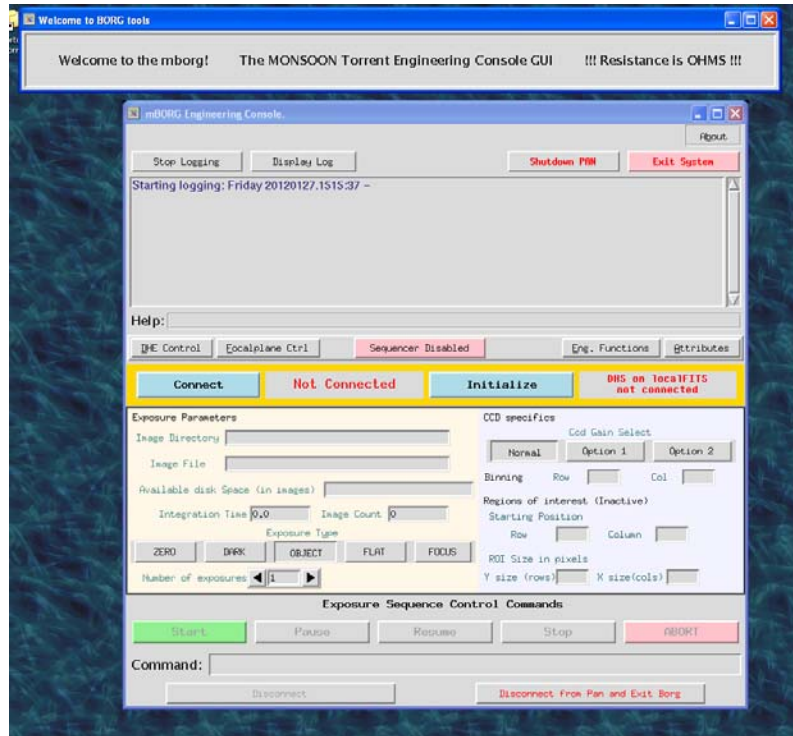


Figure 6. mBORG Window Display

Step 3.1.7 Press the **>CONNECT<** button on the MEC. The four pan Windows will be displayed as shown in Figure 5.

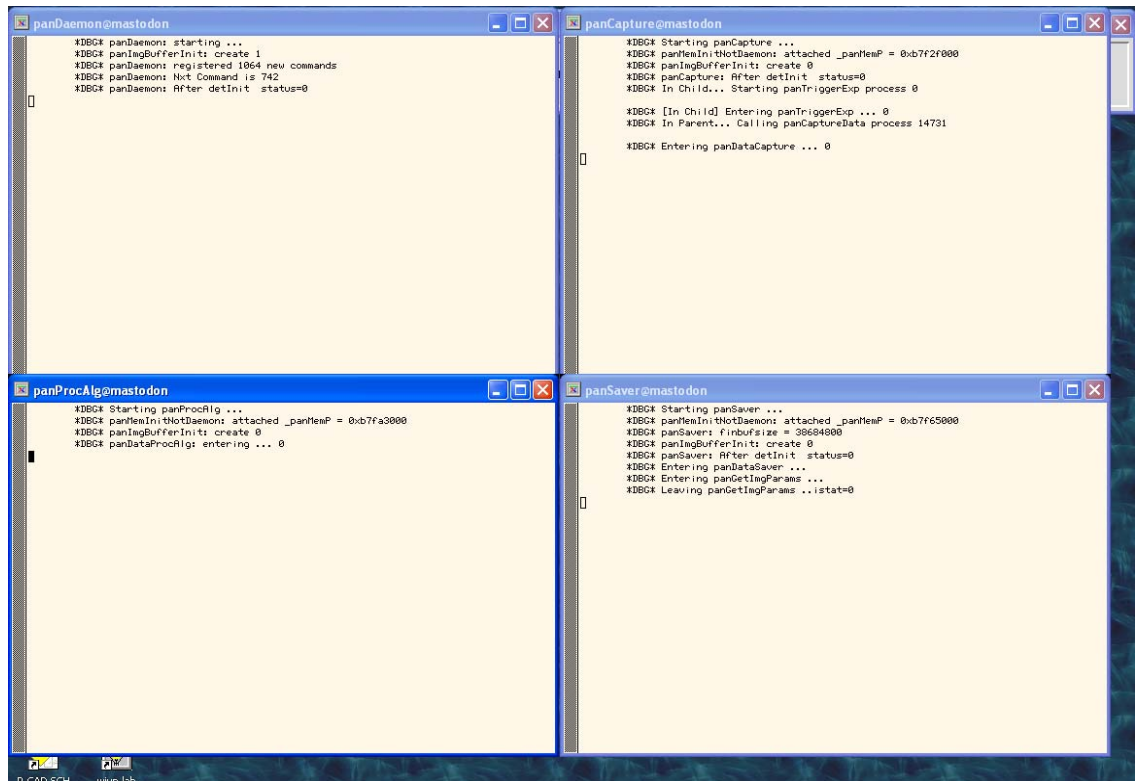


Figure 7. MEC Pan Windows

- Step 3.1.8 Press the **>DHE CONTROL<** button and execute a Reset DHE sequence by selecting “Reset DHE” from the pull down menu.
- Step 3.1.9 Press the **>DHE CONTROL<** button again and execute an Initialize DHE sequence by selecting “Initialize DHE” from the pull down menu.
- Step 3.3.10 Measure the voltage across the 100Kohm resistor. The voltage should be +1.00 (+/-0.10) V. Record the value of CH1 Current source.
- Step 3.3.11 Insert a 100Kohm resistor into the “2I+” and “2I-“ pads of the Trans Utility Board. Refer to Figure 3 for locations.
- Step 3.3.12 Measure the voltage across the 100Kohm resistor. The voltage should be +1.00 (+/-0.10) V. Record the value of CH1 Current source.
- Step 3.3.13 Remove the 100Kohm resistor from current source pads.
Do not power off the Torrent Test Unit.

3.4 Vbb Control

- Step 3.4.1 Press the >ATTRIBUTES< button. Select the “PSM_Control” option from the pull down menu. The PSM Control Attribute Display window will appear. Press the >UPDATE< button and refer to the vbbPowerEnable and vbbServoEnable fields.
- Step 3.4.2 Enable the Vbb, bit by entering a “1” in the vbbPower Enable field, then, press the **Enter** key on the keyboard.
- Set the vbbServoEnable field to 50% by entering “50”, then, press the **Enter** key on the keyboard.
- Press the >UPDATE< button and refer to the Vbb enable bit.
- Observe the negative Voltage reading on the DVM at J1 of the Util Board Under Test. Record the Vbb voltage value on the Trans Utility Acceptance Test Checklist where provided.
- Step 3.4.3 In MEC window, press the >DHE CONTROL< button. Select the “Display Mode Files” option from the pull down menu. The Mode File Select window will be displayed.
- Scroll to the bottom of the window and select the “manualNegPolarity.mod” file then press the >LOAD< button. The Mode File Select window will disappear and the .mod file will be loaded and ready for use.
- Step 3.5.4 Observe that the Vbb voltage value has changed to a positive one. Record the Vbb voltage value on the Trans Utility Acceptance Test Checklist where provided.
- Step 3.5.5 In MEC window, press the >DHE CONTROL< button. Select the “Display Mode Files” option from the pull down menu. The Mode File Select window will be displayed.
- Scroll to the bottom of the window and select the “manualPosPolarity.mod” file then press the >LOAD< button. The Mode File Select window will disappear and the .mod file will be loaded to reset the Util Board Under test to its normal operating polarity.
- Step 3.5.6 Disable the Vbb, bit by entering a “0” in the vbbPower Enable field, then, press the **Enter** key on the keyboard.

At this time the Util Board Calibration and Testing sequence is complete. Exit the mBORG and save the Util Board Acceptance Test Checklist in the appropriate document control folder. Power off the Torrent Test Unit Remove the LCB from the Test Unit. Store the board in the designated Inventory location.